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| 14. ABSTRACT<br>A wide range of topics related to the performance of the soldier in the cold have been presented. Key issues that need to be addressed are for the NATO to establish a common protocol for testing clothing on humans and manikins. This protocol must include men over 35 years old and women must also be included. A common protocol must be developed for the treatment of hypothermia and a working group should be funded to revise the survival prediction model in cold air and cold water. Furthermore Bimoclomol and Tyrosine should be considered for use in the treatment and prevention of cold injuries by all NATO medical services; and these medical services need to receive all the data on Non Freezing Cold injury from the RTO.   |             |                |                            |  |   |
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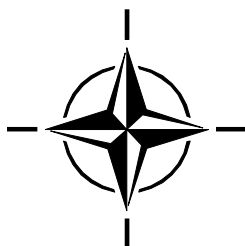
**RTO MEETING PROCEEDINGS**

**MP-HFM-168**

# **Soldiers in Cold Environments**

(Soldats en environnements froids)

Papers prepared for the RTO Human Factors and Medicine Panel (HFM)  
Symposium which was held in Helsinki, Finland from 20 to 22 April 2009.



Published April 2009

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# The Research and Technology Organisation (RTO) of NATO

RTO is the single focus in NATO for Defence Research and Technology activities. Its mission is to conduct and promote co-operative research and information exchange. The objective is to support the development and effective use of national defence research and technology and to meet the military needs of the Alliance, to maintain a technological lead, and to provide advice to NATO and national decision makers. The RTO performs its mission with the support of an extensive network of national experts. It also ensures effective co-ordination with other NATO bodies involved in R&T activities.

RTO reports both to the Military Committee of NATO and to the Conference of National Armament Directors. It comprises a Research and Technology Board (RTB) as the highest level of national representation and the Research and Technology Agency (RTA), a dedicated staff with its headquarters in Neuilly, near Paris, France. In order to facilitate contacts with the military users and other NATO activities, a small part of the RTA staff is located in NATO Headquarters in Brussels. The Brussels staff also co-ordinates RTO's co-operation with nations in Middle and Eastern Europe, to which RTO attaches particular importance especially as working together in the field of research is one of the more promising areas of co-operation.

The total spectrum of R&T activities is covered by the following 7 bodies:

- AVT Applied Vehicle Technology Panel
- HFM Human Factors and Medicine Panel
- IST Information Systems Technology Panel
- NMSG NATO Modelling and Simulation Group
- SAS System Analysis and Studies Panel
- SCI Systems Concepts and Integration Panel
- SET Sensors and Electronics Technology Panel

These bodies are made up of national representatives as well as generally recognised 'world class' scientists. They also provide a communication link to military users and other NATO bodies. RTO's scientific and technological work is carried out by Technical Teams, created for specific activities and with a specific duration. Such Technical Teams can organise workshops, symposia, field trials, lecture series and training courses. An important function of these Technical Teams is to ensure the continuity of the expert networks.

RTO builds upon earlier co-operation in defence research and technology as set-up under the Advisory Group for Aerospace Research and Development (AGARD) and the Defence Research Group (DRG). AGARD and the DRG share common roots in that they were both established at the initiative of Dr Theodore von Kármán, a leading aerospace scientist, who early on recognised the importance of scientific support for the Allied Armed Forces. RTO is capitalising on these common roots in order to provide the Alliance and the NATO nations with a strong scientific and technological basis that will guarantee a solid base for the future.

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# **Soldiers in Cold Environments**

## **(RTO-MP-HFM-168)**

### **Executive Summary**

Overall, there were 43 papers presented by 10 Nations at this Symposium. The topics ranged from basic biochemical research into cell behaviour to the effects of cold on physical and mental performance on the battlefield. Presentations given included:

- Cross-adaptation;
- Hydration in the cold;
- Operational medicine such as non-freezing cold injuries;
- Human protection in adverse environments such as the design and development of winter clothing;
- Laboratory experiments in cold air and frost nip;
- Cold water and cold air survival modeling and cold exercise physiology; and
- Key problems for the soldier such as weapons handling in the cold and the effects on marksmanship.

On one hand, NATO technology has advanced rapidly such that the latest weapon systems can pin point target a single human being or building from several miles away; yet on the other hand, the human physiology and psychology has progressed at a snail's pace for the soldier's protective equipment, in the cold. The papers presented at the symposium show that we still do not have a set of good combat clothing, gloves, face protection, tents and sleeping bags, a standard for testing humans and equipment and a reliable validated manikin and/or computer modeling system. Our human testing is only conducted on small series of young fit males, and rarely on females or older soldiers. None of this is the fault of the scientists; it is simply a lack of funds to do the research.

NATO must provide funding to establish working groups to develop:

- a) A common protocol for testing clothing on humans and manikins, and ensure that the manikins are standardized across all NATO countries;
- b) A common protocol for the treatment of hypothermia;
- c) a survival prediction model for cold weather and cold water for the testing of various clothing Ensembles;
- d) Consider the adoption of the Ulm procedure for the treatment of frostnip; Bimoclomol for the standard treatment of cold injury; and Tyrosine for introduction into the soldiers' diet;
- e) The data related to non-freezing cold injury should be extensively distributed across all the NATO medical services; and last but not least
- f) Insist that females and over 35-year old subjects are used in future experiments.

# Soldats en environnements froids

## (RTO-MP-HFM-168)

### Synthèse

Durant ce symposium, 43 exposés furent présentés par 10 nations. Les sujets allaient de la recherche biochimique de base sur le comportement cellulaire dans le froid aux effets du froid sur les performances mentales et physiques sur le champ de bataille. Les présentations incluaient notamment :

- L'adaptation croisée ;
- L'hydratation dans le froid ;
- La médecine opérationnelle (blessures dues au froid sans gelures) ;
- La protection humaine dans les environnements hostiles telle que la conception et le développement de vêtements d'hiver ;
- Les expériences de laboratoire en air froid et sur la morsure du gel ;
- La modélisation de la survie en eau froide et en air froid ainsi que la physiologie des exercices au froid ;
- Les problèmes principaux pour le soldat tels que le maniement des armes dans le froid et l'impact sur la précision du tir.

Tandis que la technologie de l'OTAN a avancé si rapidement que les derniers systèmes d'armes peuvent viser avec précision un simple individu ou un bâtiment à plusieurs kilomètres de distance, la physiologie et la psychologie humaines ont progressé à un rythme d'escargot en ce qui concerne le matériel de protection du soldat dans le froid. Les exposés de ce symposium ont démontré que nous ne disposons toujours pas d'un bon ensemble tenue de combat, gants, protection du visage, tentes et sacs de couchage, ni d'une norme pour le test sur les êtres humains et les équipements, ni d'un mannequin validé fiable et /ou d'un ordinateur modélisant le système. Nos tests sur les êtres humains sont essentiellement effectués sur un petit nombre de jeunes hommes en pleine forme et rarement sur des femmes ou des sujets plus âgés. Ceci n'est pas dû aux scientifiques, mais simplement à un manque de fonds dédiés à ces recherches.

L'OTAN devrait assurer le financement nécessaire à la création de groupes de travail pour :

- a) développer un protocole commun pour essayer l'habillement sur des humains et des mannequins, et s'assurer que ces mannequins soient normalisés au sein des pays de l'OTAN ;
- b) développer un protocole commun pour le traitement de l'hypothermie ;
- c) développer un modèle de prévision de survie par temps froid et en eau froide pour l'essai de divers ensembles d'habillement ;
- d) envisager l'adoption du procédé d'Ulm pour le traitement des morsures du gel, du Bimoclomol pour le traitement standard des dommages dus au froid et de la Tyrosine pour l'introduction dans le régime du soldat ;
- e) distribuer systématiquement les données liées aux dommages dus au froid sans gelures dans tous les services médicaux de l'OTAN ; et, enfin, mais ce n'est pas le moindre,
- f) insister pour que des femmes et des sujets âgés de plus de 35 ans soient employés dans de futures expériences.